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FM 5-20

WAR DEPARTMENT

ENGINEER
FIELD MANUAL



CAMOUFLAGE

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CAMOUFLAGE

**PREPARED UNDER DIRECTION OF THE
CHIEF OF ENGINEERS**



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ENGINEER FIELD MANUAL

CAMOUFLAGE

(The matter contained herein supersedes TR 195-45, February 1, 1926, and chapter I, part two, Engineer Field Manual, volume II, June 25, 1932.)

SECTION I

GENERAL

■ 1. PURPOSE AND SCOPE.—*a.* Camouflage is work done to provide protective concealment of matériel, troops, or military works from enemy observation from airplanes, captive balloons, and ground observation posts.

b. Observation is of two kinds:

(1) *Direct observation*—by direct vision which may be aided by field glasses or telescopes.

(2) *Indirect observation*—from the study of photographs.

c. (1) Indirect observation provided by aerial photographs is by far the more effective. The skill of the expert photograph interpreter in translating apparently insignificant details into important military intelligence can hardly be realized by one who has not specialized in it.

(2) Aerial photographs may be classified as—

(a) *Panchromatic*, taken on film which is sensitive to practically all colors and on which objects register in black, white, or gray according to the color and amount of light they reflect.

(b) *Infrared*, taken on special film which, while it is somewhat sensitive to most colors, is especially sensitive to infrared light, and on which objects register in black, white, or gray, primarily according to the amount of infrared light they reflect. Thus the relative shades of gray in which objects register on infrared film differ from the relative shades of gray in which they register on panchromatic film.

(c) *Color photographs*, taken on special film on which objects register in approximately their natural colors.

(3) The general considerations and technique of camouflage presented in this manual are effective primarily against direct observation and panchromatic photographs. They are also effective against infrared and color photographs provided

that materials are used which reflect infrared and colored light in the proper quantities.

■ 2. CAMOUFLAGE AND THE AERIAL PHOTOGRAPH.—*a.* The roads, paths, houses, towns, etc., in peace appear in certain fixed patterns on aerial photographs. The pattern may be large and simple as in a farming district, or it may be intricate and confused as in broken, wooded areas. In war, these peace-time patterns are disrupted. War requires new roads, new paths, trenches, battery positions, etc., and rarely will any of these fail to register on an aerial photograph as separate and distinct from the normal pattern of the terrain unless properly camouflaged. An intricate terrain pattern makes the work of the photograph interpreter more difficult and the work of camouflage easier.

b. Photograph interpreters identify objects by—

(1) *Form*.—In searching for objects of human origin, regular forms quickly attract the eye. Camouflage should hide any regularity of form, either in the shape of individual objects or the lay-out of a group of objects, and should not itself have an identifiable form.

(2) *Shadow*.—Each object casts a typical shadow by which it can often be identified on an aerial photograph. Camouflage must break up this shadow so that the object cannot be identified, nor should the camouflage itself cast an identifiable shadow.

(3) *Texture*.—The smoother a surface is the more light it reflects and the lighter it photographs. Standing vegetation is irregular; it casts shadows, absorbs light, and therefore photographs dark. Roads, paths, and bare fields present a regular surface and photograph light. Camouflage must match the texture of the surrounding natural features so that it will photograph the same shade.

(4) *Color*.—In panchromatic photographs, variation in color has little effect on the resulting shade of gray as long as the color contrast is not marked. With infrared and color photographs, and direct observation, the exact matching of colors becomes more important. Camouflage materials must then match the surrounding color both in visible and infrared color components so that no contrasting pattern results.

c. Photograph interpreters are assisted in locating otherwise successfully camouflaged objects by the presence of roads, tracks, or trampled areas in the vicinity. These features photograph light due to reduced texture. All ground forces require roads or trails to get into position and to maintain their supplies after getting into position. The work of getting into position, particularly with heavy equipment, requires movement of personnel in the immediate vicinity which is likely to result in tracks and trampled areas. All of these signs of activity may register on an aerial photograph and disclose the position unless proper camouflage precautions are taken. (See fig. 1.)

d. Photograph interpreters detect changes in the appearance of an area by comparing successive photographs taken days or even weeks apart. For this reason, camouflage measures taken in an area which has been photographed by the enemy should not change the appearance of the area as shown by an aerial photograph.

e. Most aerial photographs of enemy territory must be taken from high altitudes and hence are of small scale. However, the photographs can be enlarged or magnified up to three or four diameters without undue loss of detail. Aerial photography is normally conducted so as to provide stereoscopic pairs with which magnifying stereoscopes are used, enabling the photograph interpreter to detect even small defects in a camouflaged position.

■ 3. METHODS.—*a. Camouflage can be accomplished by any one or more of the following methods:*

(1) *Hiding*.—Completely concealing an object by constructing overhead cover or lateral screening.

(2) *Blending*.—Making an object indistinguishable from its surroundings by breaking up its form and shadow. This method is particularly valuable where the terrain pattern is intricate.

(3) *Deceiving*.—This method includes—

(a) Making an object appear to be something else, for example, constructing an airplane hangar so that it looks like a barn.

(b) Using dummies to mislead the enemy as to troop dispositions and to draw his attention away from actual positions.

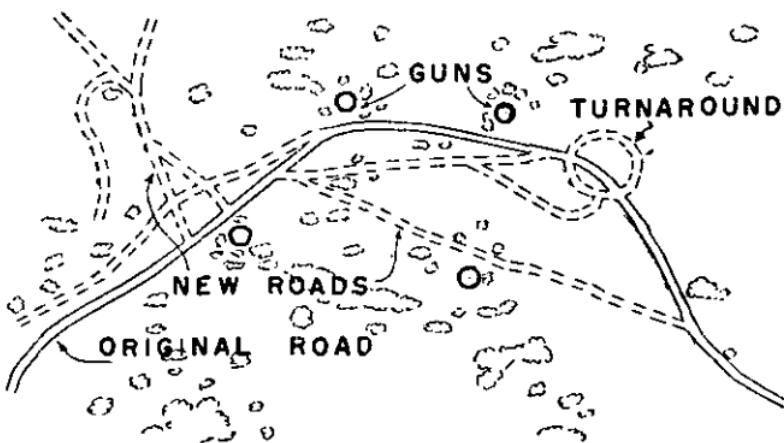


FIGURE 1.—Signs of activity around camouflaged position.

b. The method of camouflage employed depends on a number of factors, including the size, location, and lay-out of the object to be concealed; the nature of the surrounding terrain; the type of camouflage materials available; the type

of enemy observation; and, most important, whether or not the area has been photographed by the enemy. If it has not been photographed, any method can be used; if it has been photographed, that method which offers least disturbance to the existing pattern should be used.

■ 4. FUNDAMENTAL REQUIREMENTS.—*a.* The requirements for successful camouflage, listed in order of importance, are—

- (1) Proper choice of position.
- (2) Good camouflage discipline.
- (3) Proper erection of camouflage material.
- (4) Proper choice of camouflage material.

b. (1) *Choice of position.*—(a) The points to be considered include—

1. *Mission.*—Location such that occupying troops can accomplish their mission.
2. *Access.*—Ease of access without making telltale tracks either during installation, supply of food and ammunition, or relief of personnel.
3. *Concealment.*—Natural concealment or ease of concealment by camouflage.
4. *Deflade.*—Prevention of enemy ground and balloon observation.
5. *Lay-out.*—Suitable locations for auxiliaries to the main position, easily camouflaged and easily accessible yet not so close as to give away the main position. The discovery of one accessory may draw attention to the area and force the removal of the entire installation. *The lay-out should be planned in detail before the position is occupied.*

(b) The best way to choose a position is to use an aerial photograph of the area to supplement the necessary ground reconnaissance. Maps are often useful in determining whether or not the mission can be accomplished from a given location. Ground reconnaissance should also determine the location of local materials which can be used for camouflage purposes.

(c) When reconnoitering for a position, look first for natural cover; second, for country where the terrain pattern is intricate and confused rather than regular. Remember that an aerial photograph is a kaleidoscopic pattern of small

features. Any of these features can change in texture or color without the cause for this change being apparent. What attracts the attention of the photograph interpreter is a new shape or a changed shape in the general pattern.

(d) A position satisfactorily fulfilling all conditions is seldom found. However, due to lack of consideration of the foregoing details, a position is often chosen which is difficult to camouflage, whereas adequate reconnaissance would have disclosed a more suitable one nearby.

(2) *Camouflage discipline*.—Camouflage discipline has two objectives:

(a) The prevention of any change in the appearance of the visible terrain by personnel, for example, making paths or tracks, cutting trees or sod, or leaving any foreign objects exposed, in the vicinity of the position.

(b) The maintenance of camouflage material, for example, repairing it when damaged, and keeping it up to date by changing its appearance or color as that of the terrain changes with the season.

(3) *Erection*.—Camouflage material should be so erected that—

(a) It does not have a regular form or cast either a regular or well-defined shadow.

(b) It conceals the form and shadow of the object camouflaged.

(c) It hides the tracks of constructing personnel.

(4) *Materials*.—Materials chosen should—

(a) Match the surrounding terrain in color and texture.

(b) Be easy to maintain, considering the length of time the position will be occupied.

c. Since aerial photographs are usually made from a height of $1\frac{1}{2}$ to $3\frac{1}{2}$ miles or even more, work must be planned on a scale in proportion to that distance, and one must think in terms of the perspective of the position from that distance.

■ 5. INSPECTION.—The effectiveness of camouflage may be checked by examining an aerial photograph of the camouflaged position. Even in good positions, some minor corrections will probably be necessary. Where flagrant mistakes have been made, it may be advisable to move to an entirely

new position. In this case the original position might well be maintained as a dummy, in order to deceive the enemy as to dispositions in the areas as a whole. Maintenance requirements may be determined by rephotographing the position at appropriate intervals.

■ 6. ARTILLERY FIRE.—*a. Areas subject to.*—Artillery fire is placed on a target by—

(1) Spotting shots by direct observation from ground observation posts, balloons, and airplanes.

(2) Unobserved fire, for which either the map position of the target, or the position of the target with respect to a point on which fire has been registered, must be known. This information is obtained from aerial observation, both direct and indirect.

Therefore, all camouflage in areas subject to artillery fire must be effective against *all* types of observation.

b. Areas not subject to.—(1) Air bombing is the only means of placing fire on targets not subject to artillery fire. Bombs are aimed by direct observation; no matter how accurately a target has been located on a map, it cannot be effectively bombed unless the bomber can train his bomb sights directly on the target, or on a reference point in the immediate vicinity of the target. Hence, camouflage to protect against air bombing need be effective against direct airplane observation only, greatly simplifying the camouflage problem.

(2) Dummies can be effectively employed to draw fire away from real targets. Dummies need not be exact reproductions of objects; all that is necessary is to reproduce the proper form and shadow with brush, debris, etc.

(3) The antiaircraft defense can be assisted by camouflaging probable targets so as to delay the action of enemy bombers by making it difficult for them to aim their bombs. Any delay to the bombers makes them more vulnerable to fire from the defense.

■ 7. DUTIES OF ENGINEERS.—*a.* The duties of engineers include the supply of camouflage material together with the supervision and inspection of its use. This work is carried on by the engineer troops comprising the army and GHQ camouflage battalions, working in conjunction with those

engineer staff officers designated as camouflage officers. Camouflage personnel advise and lend assistance to the commanders of troops whose activities should be camouflaged, particularly in the selection of positions which lend themselves to effective camouflage. They suggest corrective measures where errors of camouflage technique or breaches of camouflage discipline are discovered. They manufacture camouflage materials and see to their proper distribution. They demonstrate correct camouflage technique and operate schools of camouflage instruction.

b. The course of instruction at a camouflage school should include theory taught by lectures and training publications; position reconnaissance; lay-out of a position on the ground with all its elements; erection of wire supports and camouflage coverings; study of aerial photographs of this work; camouflage of guns, tanks, roads, etc., during maneuvers; and strict attention to camouflage discipline. The quickest way to teach officers and men to conceal positions and to understand how tracks and other signs of activity show up is to let them see aerial photographs of their own work. They can recognize all the features of the picture and readily see any errors in their attempts at camouflage. The following general outline of instruction is suggested:

- (1) Lecture on camouflage: Outline of proposed course of instruction, history, conditions under which camouflage is important, aerial photography and observation, fundamental principles of camouflage, camouflage materials that will be available for the course of instruction.
- (2) Study of instructions for reading aerial photographs.
- (3) Study of instructions for aerial observers.
- (4) Lecture on military intelligence, showing how information of the enemy's position is obtained and how this information is disseminated.
- (5) Study of instructions for camouflage.
- (6) Field reconnaissance for selection of positions in varied terrain.
- (7) Sketching positions showing plan and cross section, quantity of stakes, wire, and other material required.
- (8) Laying out positions in detail. Drafting of rules for circulation and camouflage discipline at the position.

- (9) Drill in stretching wire and erecting camouflage.
- (10) Study of aerial photographs taken before and after camouflaging as well as before occupation of the position.
- (11) Practical application of camouflage in maneuvers.

SECTION II

MATERIALS AND CONSTRUCTION METHODS

- 8. CLASSES.—*a.* Camouflage materials are of two classes—natural and artificial.

- (1) *Natural materials* include—
 - (a) Green vegetation such as fresh grass and foliage, branches in leaf, sod, etc.
 - (b) Dry vegetation, such as dead leaves, bare brush, etc.
 - (c) Debris natural to a shell-torn village, battlefield, or similar locality.
 - (2) *Artificial materials* include—
 - (a) Fishnets garnished with oznaburg, burlap, or like material.
 - (b) Chicken wire garnished similarly.
 - (c) Garlands.

- b. Natural materials possess the following advantages and disadvantages as compared to artificial materials:

- (1) *Advantages.*—(a) They match the color and texture of the locality more easily when properly used.
 - (b) They are effective against all types of aerial photographs, particularly the infrared and color photographs.
 - (c) They reduce the quantity of camouflage supplies to be furnished from the rear.

- (2) *Disadvantages.*—(a) They cannot be prepared in advance for quick erection; all work must be done at the site.

- (b) Green vegetation must be renewed frequently to replace wilted material, requiring exceptionally strict discipline of maintenance personnel to prevent making visible tracks.

- c. In general, natural materials give the best results. Artificial materials are used mainly for—

- (1) Positions of a more or less permanent nature when maintenance of natural materials would be difficult.

- (2) Situations in which time and labor are not available for gathering and erecting natural materials.

(3) Localities where suitable natural materials are difficult to obtain in sufficient quantities.

■ 9. NATURAL MATERIALS.—*a. Vegetation.*—(1) Vegetation, green or dry, can either be placed directly on and around an object or can be supported over an object to form an overhead cover. Green vegetation must be placed in its natural position, otherwise it will reflect light differently and show up in aerial photographs. For example, leafy branches thrown on upside down photograph too light, because the under side of a leaf is a different color from the upper side. Dry vegetation can be placed in any position, although it is generally better to place it as naturally as possible. With both green and dry vegetation the density of cover must be such as to match the texture of the locality.

(2) In making an overhead cover of green vegetation two methods are successful (see fig. 2)—

(a) Stretch wires overhead at different heights and in several directions, fastened to trees or posts. Suspend small trees, branches, or shrubs by their tips from these wires.

(b) Stretch strips of chicken wire on a suitable supporting frame, placing the strips side by side without overlap and without fastening the adjacent edges together. Men work from underneath through the slits between the strips and stick cut branches, shrubs, etc., in the chicken wire so that the butt ends project down 8 to 12 inches. The butt ends are then wired so as to hold the branches upright.

(3) Dry vegetation used for overhead cover can be thrown on the supporting frame in any position. The proper texture is secured by varying the density of material.

b. Debris.—Debris suitable for camouflage usually occurs only in localities where the terrain pattern is very intricate and confused, with many irregular forms and shadows. Debris is placed over and around an object in such a locality so as to break up its form and shadow into an irregular pattern which will blend with the surrounding pattern. Debris requires no renewal and little maintenance, but its use is limited to suitable localities.

■ 10. ARTIFICIAL MATERIALS.—*a. Fishnets.*—(1) Because of their portability, fishnets are used principally in mobile situations

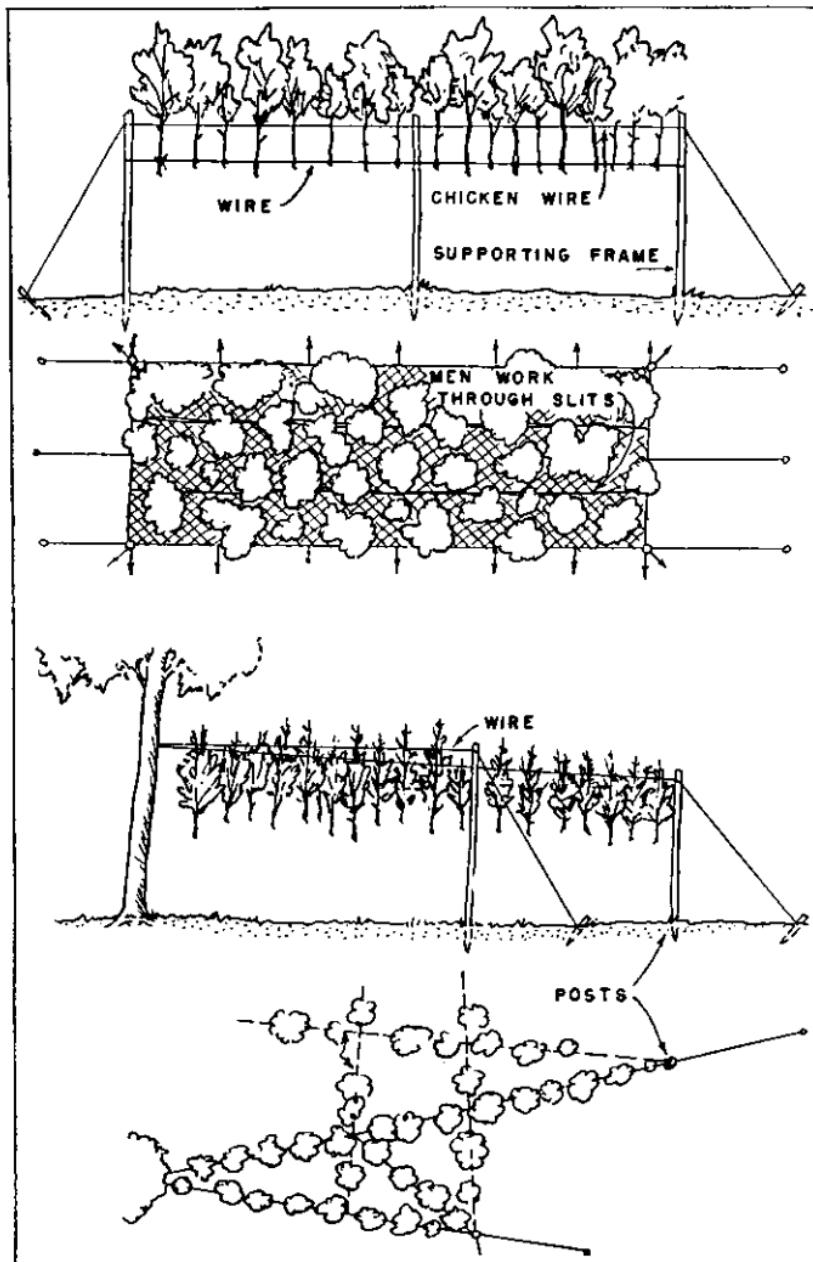


FIGURE 2.—Overhead covers of natural materials.

for artillery, tanks, trucks, etc., and are issued in the following standard sizes, all with 2½-inch mesh:

	Size of fishnet (feet)
Machine guns and mortars.....	12 by 12
Antitank guns and their prime movers.....	22 by 22
Light tanks.....	30 by 30
Medium tanks.....	45 by 45
Field and antiaircraft artillery, and trucks.....	36 by 44

(2) Fishnets are used to provide overhead cover for an object in either of two ways: As a "flat-top," supported on a wire frame above the object (as for guns in firing position), or as a "drape," placed over and around the object (as for trucks or tanks). In either case, a fishnet must be tied in with some natural feature, such as a clump of trees or brush, to be effective. (See fig. 3.)

(3) Fishnets shrink when they get wet and expand as they dry out; hence when used as flat-tops they must be adjusted with each change in weather conditions. They deteriorate more quickly than chicken wire and should therefore be used for the more temporary installations. When fishnets must be installed initially on positions which will be occupied for a long time, they should be replaced with chicken wire at the first opportunity.

b. *Chicken wire*.—Chicken wire is issued for use in standard strips 6 feet wide by 30 feet long, having a 2½-inch mesh. It is normally used, in more or less stable situations, for overhead flat-top covers supported on wire frames. Compared to fishnets, chicken wire can bridge longer gaps between supports without sagging, is more permanent, will not shrink or expand due to moisture conditions, and in case of fire will not drop the whole fabric on men and material underneath. It is more bulky, less easily handled, and is too stiff for use as a drape.

c. *Garlands*.—Garlands are made by doubling a 40-inch length of 2-inch wide oznaburg or burlap and knotting the double length in the center. These knots are then secured to a light wire framework at 8-inch intervals in such a way that they will not slide on the wire. Garlands are useful for thickening overhead cover, whether natural or artificial,



FLATTOP



DRAPE

FIGURE 3.—Uses of fishnets.

and for extending irregularities in the edges of nets. (See fig. 4.)

■ 11. GARNISHING.—*a.* The standard material for garnishing is 7-ounce, 40-inch wide oznaburg, a cotton cloth something like heavy unbleached muslin. Burlap may also be used.

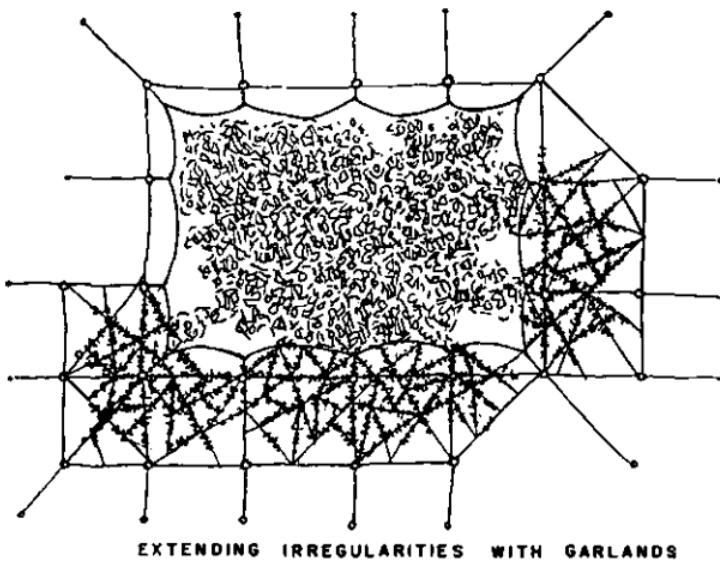
b. (1) Both fishnets and chicken wire are garnished by weaving strips of oznaburg, about 5 feet long and 2½ inches wide into the net along irregular lines. Each end of each strip is allowed to dangle about 8 inches from the under side of the net.

(2) In garnishing fishnets, the strips of oznaburg are woven close together in the center of the net so that about 70 percent of the mesh openings are covered. The garnishing is thinned out gradually at the edges of the net. Garnishing should be very irregular in outline. (See fig. 5.) The thickly woven central portion serves to conceal what may be under it, and the thinned edges cast a faint, indeterminate shadow which, merging into the inequalities of the terrain, renders it unnoticeable in aerial photographs. Since the thinned edges allow objects under them to show, the cover must be much larger than the object over which it is placed.

(3) Each standard strip of chicken wire is garnished throughout in one of two ways, either thick for use in center portions of covers or thin for use at edges.

■ 12. COLORS OF NETS.—*a.* Garnishing for nets must be colored to fit the locality where the net is used. In a stable situation, nets may be furnished to the using units already garnished and colored to fit the particular sites. In mobile situations, garnishing or garnished nets may be furnished in a neutral color but must be finally colored on the site. In any case, coloring must be checked by air observation to prove its effectiveness. Nets colored in one solid color throughout generally give as good results as nets with mottled patterns of several colors and are easier to prepare.

b. (1) Garnishing may be colored either by paint or dye. Paint is the more satisfactory material as most dyes fade rapidly. A casein-bound cold-water paint, furnished in paste form, is the standard material. It is furnished in a variety



EXTENDING IRREGULARITIES WITH GARLANDS



GARLANDS USED TO THICKEN NATURAL COVER

FIGURE 4.—Garlands.

NOTE.—Care must be taken not to obliterate previously existing features.

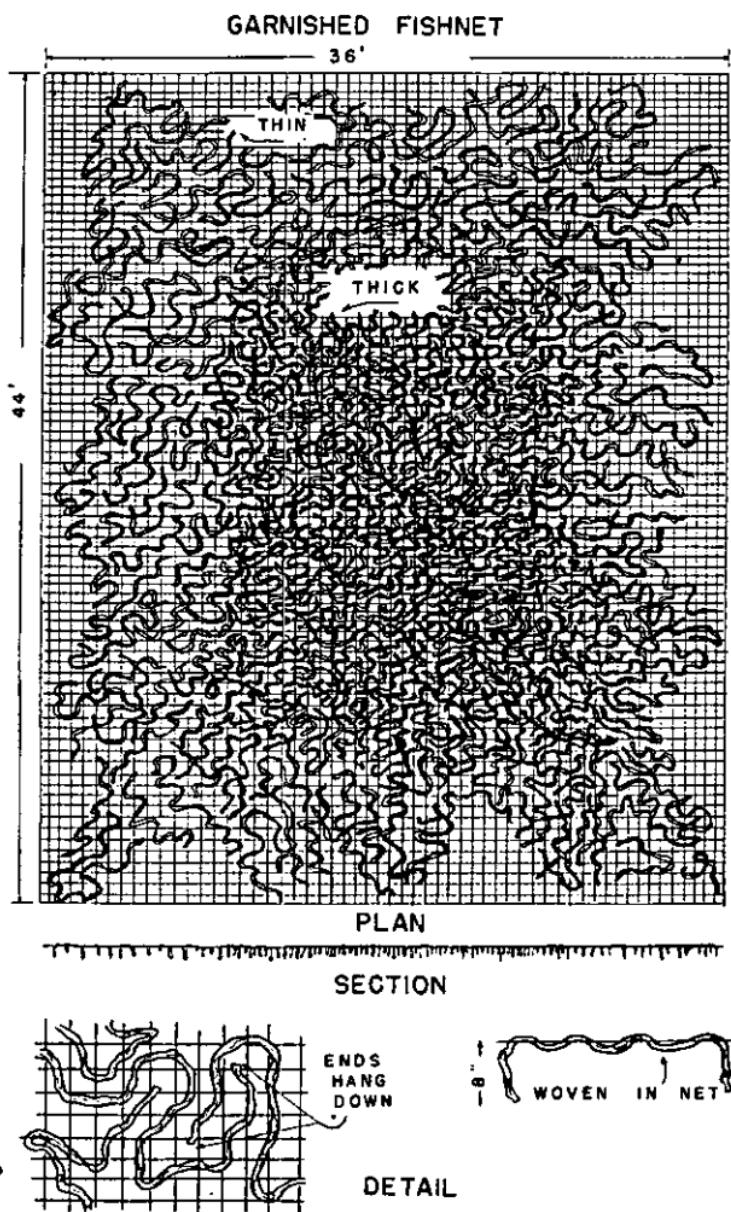


FIGURE 5.—Garnishing.

of colors including burnt umber, burnt sienna, yellow ochre, green, golden yellow, ultramarine blue, black, white, and red.

(2) To match a particular piece of terrain, any two or more of these colors can be mixed to form a new color. The proportions of basic colors to be used must be determined by trial and error for any given locality. Some sample mixtures designed to blend with summer foliage are—

	Percent
(a) Green	75
Golden yellow	10
Burnt sienna	15
(b) Green	60
Golden yellow	15
Burnt umber	15
Red	10
(c) Green	85
Burnt umber	15

■ 13. PAINTING.—*a.* Paint can be applied by—

(1) Paint brush, which requires excessive labor.

(2) Spray gun, which is especially useful for correcting colors in the field.

(3) Dipping in a vat of paint, which is the quickest method, but requires much more paint and thereby increases the weight of the finished product materially.

b. Garnishing can be painted—

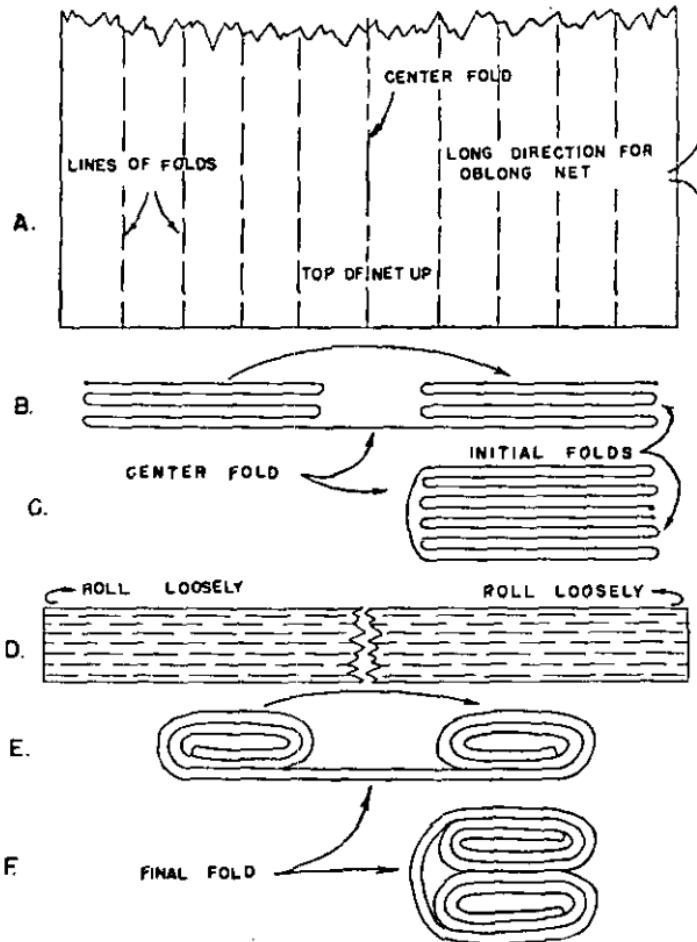
(1) Before weaving, while in the form of large pieces (bolts or rolls) or of strips ready for use. Painting before weaving is economical of paint but makes the material stiff and hence slightly harder to weave. Large pieces are easier to paint than strips, but when strips are cut therefrom their edges are unpainted which changes the color of a garnished net appreciably. This is unimportant where final matching of colors is done in the field.

(2) After being woven into the net. This method is particularly useful when the garnished nets are painted by dipping. Both upper and under sides of the net must be painted.

■ 14. FOLDING OF FISHNETS.—When not in use, fishnets should be folded carefully in such a way that they can be unfolded

for use without confusion. The best method is shown in figure 6.

■ 15. ERECTING WIRE FRAME.—*a. General.*—(1) There are many needs for flat-top overhead covers of chicken wire or



PROCEDURE

1. SPREAD FLAT, (A.) AND FOLD TOWARDS CENTER, (B. AND C.) TO FORM LONG FOLDED STRIP (D.)
2. ROLL LOOSELY FROM BOTH ENDS, (E.) AND FOLD ROLLS TOGETHER, (F.)

FIGURE 6.—Folding of fishnets.

fishnet. These covers must be supported on some kind of frame, ordinarily of wire. The two methods of erecting wire frames described in *b* below require only soft wire, rough stakes and posts, and a few nails. They can be easily erected by untrained men.

(2) Posts for wire frames should be about 3 inches in diameter, cut square at the top and sharpened at the bottom, and about 6 inches longer than the desired height of net. Only soft steel or iron wire, about No. 12 or heavier, should be used for wire frames. If only hard wire is obtainable, it is easily annealed by heating it until red hot and allowing it to cool gradually. It is impossible to do good work with hard wire.

b. Methods.—(1) The following method lends itself to any size or shape of cover and may be used to support either a garnished net or plain chicken wire used as a base for natural materials. (See fig. 7①.) It is slower than the method described in (2) below but provides a more permanent frame.

(a) Lay out the posts about 12 feet apart in each direction in the area to be covered.

(b) Drive the outside rows of posts into the ground so they will stand alone, and drive strong guy stakes about 12 feet out from them.

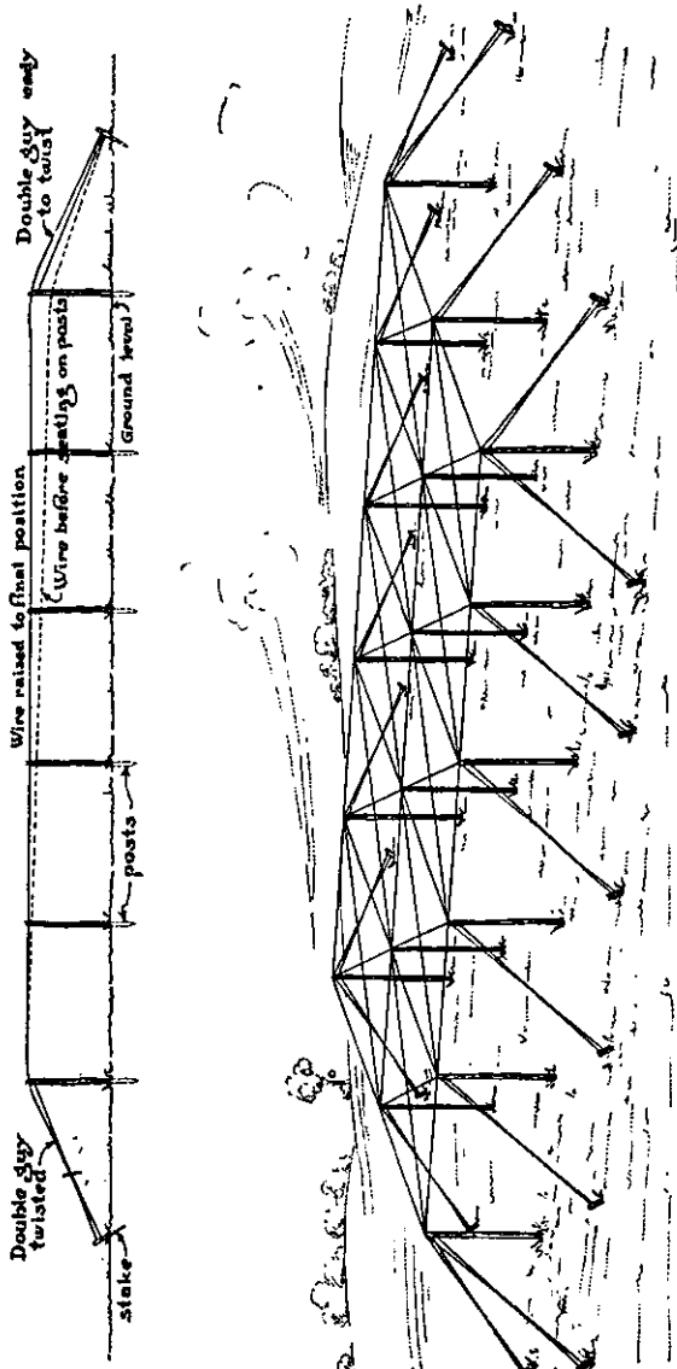
(c) Drive two nails about 1 inch apart in the head of each post.

(d) Wind one end of the wire coil fast around the head of a corner post, then take a turn around the guy stake and back over the top of the post between the nails, forming a double guy.

(e) Stretch the wire along the line of the posts, using several men. Support the wire by a nail about 1 foot below the top of the last post of the row, then give it a turn around the guy stake, bring it back, and make it fast to the top of the post. Cut the wire from the coil at this point.

(f) Push the wire up over the tops of all the posts in the row and seat it between the nails, thus stretching it tight.

(g) Proceed similarly with each parallel line of posts, then in the same manner run wires at right angles to the first series, forming squares.



① FIGURE 7.—Methods of erecting flat-top wire frame.

(h) Run diagonal wires across each line of posts, placing the wire between the nails.

(i) Tighten all guy wires by twisting with a rack stick or large nail. Tighten the diagonal wires in the same manner at all crossings. This will tighten the whole frame.

(j) Clinch the nails over the wire. Drive them down flat to avoid catching the net when spread.

(k) After erection, any of the interior posts may be shifted in position to accommodate the needs of the occupying troops without affecting the stiffness of the frame. By placing additional posts on the edge and wiring them as above, any irregular shape may be made.

(2) The following method is used primarily to support fishnets, but may be used to support chicken wire and natural materials. In addition to soft wire, stakes, posts, and nails, a steel or heavy wire ring about 6 inches in diameter is needed. (See fig. 7 ②.)

(a) Lay out the posts at intervals of about 12 feet around the edge of the area to be covered by the net, and drive them into the ground so they will stand alone.

(b) Lay out the wires which run radially from the ring in the center of the area over the tops of the posts and down to the stakes. Cut these wires about 15 feet beyond each post.

(c) Place the wires which run to one set of opposite corners over their respective posts and stake the ends down. The wires are held in place on the posts by clinching a nail on them. The posts should be slanted toward the center about 1 foot when the wires are first staked down; then the posts are pushed out until erect, tightening the wires. Wires can be tightened further by driving the stakes deeper.

(d) Repeat (c) above for the wires running to the other set of opposite corners, and then continue with each opposite set of wires until all are erected.

(e) Place two additional guys on each corner post.

(f) Run a wire around the outside of the posts, fastened to each post near the top with a nail.

(g) Run two or three irregular concentric rings of wire around the "spokes" of the frame near the outer edge to keep the net from sagging between the spokes.

(h) Use interior posts as props where needed to keep the net level.

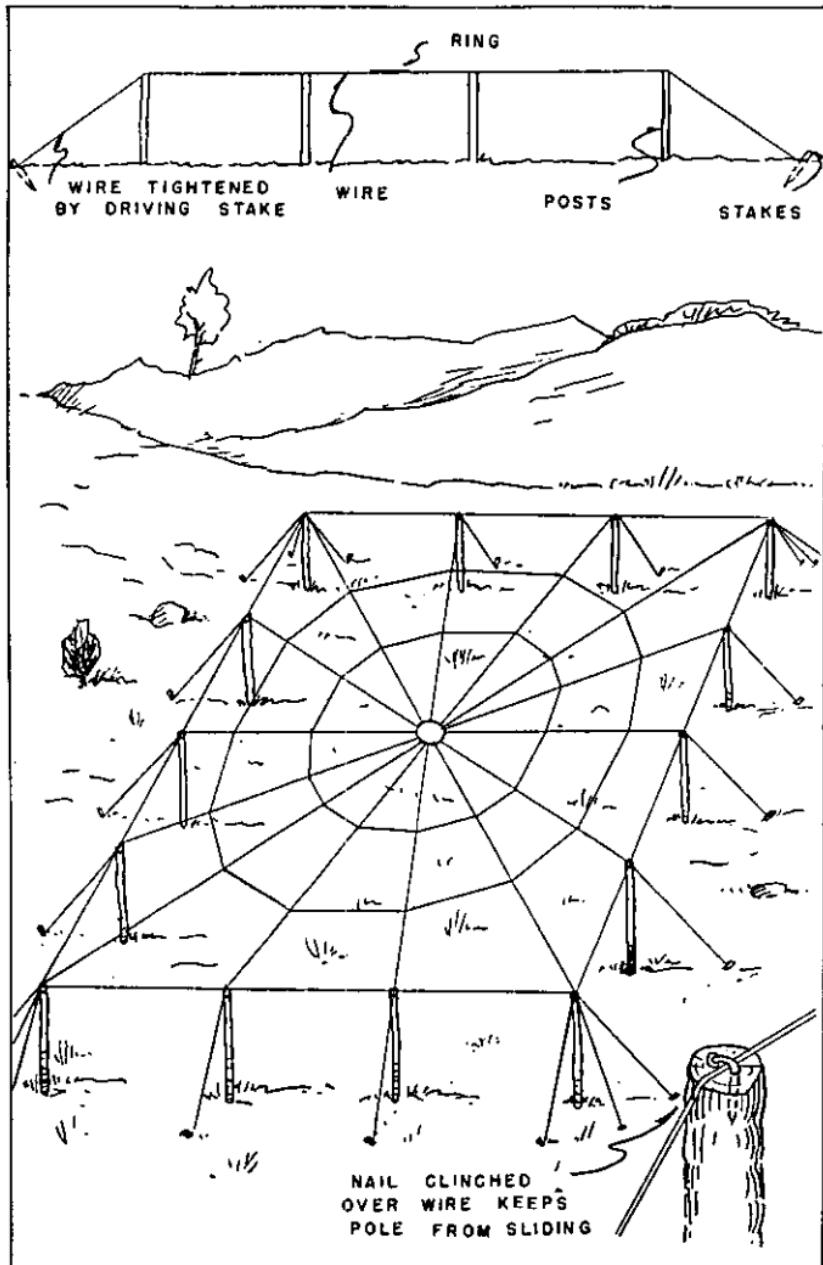


FIGURE 7.—Methods of erecting flat-top wire frame—Continued.

■ 16. SHAPE OF COVERING SURFACE.—*a.* Fishnets set up under trees, among bushes, or out in rough, uneven ground may be set up loosely with wires or propped up by poles. This gives a rough-appearing surface with many dark shadows and light spots which photograph like the bushes or uneven ground. The square shape of the net should be broken up to fit into the brush or trees by covering parts of the net with brush or by building out the sides of the net with brush hung on wires.

b. Fishnet or chicken wire camouflage on open, level ground should be stretched taut and parallel to the slope of the ground. If not stretched parallel it will cast shadows so as to make its form discernible. If possible, arrange to have the shadows which will be cast on the north, east, and west sides of the cover taken up by a hedge, building, trench, or similar feature. When there is no existing edge for one of the sides, exaggerated irregularity of outline of the camouflage is absolutely essential; not irregularities of 2 to 6 feet but irregularities of 20 to 30 feet. Right lines and especially right angles reveal camouflage material more often than anything else.

c. A flat-top used to conceal a large, high object (about 10 feet or more above the ground) should be "terraced" by placing additional smaller flat-tops under the edges of the main flat-top. The small flat-tops should be about halfway between the ground and the main flat-top and should extend both under and outside of the edges of the main flat-top. Their functions are to prevent oblique observation under the main flat-top and to assist in breaking up the shadows of the edges of the main flat-top.

d. Mound-shaped camouflage with closed, sloping sides makes the occupant feel safer, but in most cases it is quite visible because the sides away from the sun reflect but little light compared to the sides toward the sun and therefore show up much darker.

■ 17. ROAD SCREENING.—*a.* Road screening is erected to prevent balloon or ground observers from seeing traffic pass along exposed roads. Its purposes are to prevent the enemy intelligence observers from counting the road traffic, and to keep the

enemy from observing and shelling vehicles moving over the road.

b. Most roads may be sufficiently screened by a lateral screen, guyed solidly to the ground. Height of the screening depends on the enemy's line of sight and the height of the vehicles using the road. It should be about 20 feet from the road to allow free room for guy wires. Gaps must be left at intervals in the screening for lateral communication. In a salient, lateral screening may be necessary on both sides of a road to prevent enemy observation. Figure 8 gives details of lateral screens.

c. When a road is nearly perpendicular to the front, it may be economical to echelon the screening as shown in figure 8. The angle of these wings of screening, their length, and distance apart are determined by drawing a diagram showing the road and the enemy's line of sight. Allow plenty of overlap between successive screens.

d. A road perpendicular to and sloping downward toward the front must often be cross-screened. It may require lateral screening also. Figure 9 gives details of cross-screening.

e. Road screening can be made from—

(1) *Brush*, either cut on the site and woven with smooth wire into a screen, or fabricated in rolls at some favorable point and hauled to the site for erection. It makes a very durable road screen for lateral and echelon screen. (See fig. 10.)

(2) *Garnished chicken wire*.—Natural material such as grass, cornstalks, etc., can be used, but a more satisfactory method of garnishing is with oznaburg strips 3 inches wide as shown in figure 10. Plain oznaburg can be used but dark colored material is preferable. When chicken wire is used for overhead cross-screening, a 3-foot width is used, with oznaburg strips 3 inches wide and 12 feet long woven once across the netting and back again, leaving two 3-foot ends hanging below. These dangle down and allow high loads to pass through but obstruct the view to a 6-foot depth.

(3) *Oznaburg*, in standard 40-inch wide strips, is suitable for either lateral or cross-screening, and for overhead cross-screening on account of its light weight. It should be slashed as shown in figure 9 to cut down wind resistance. A large

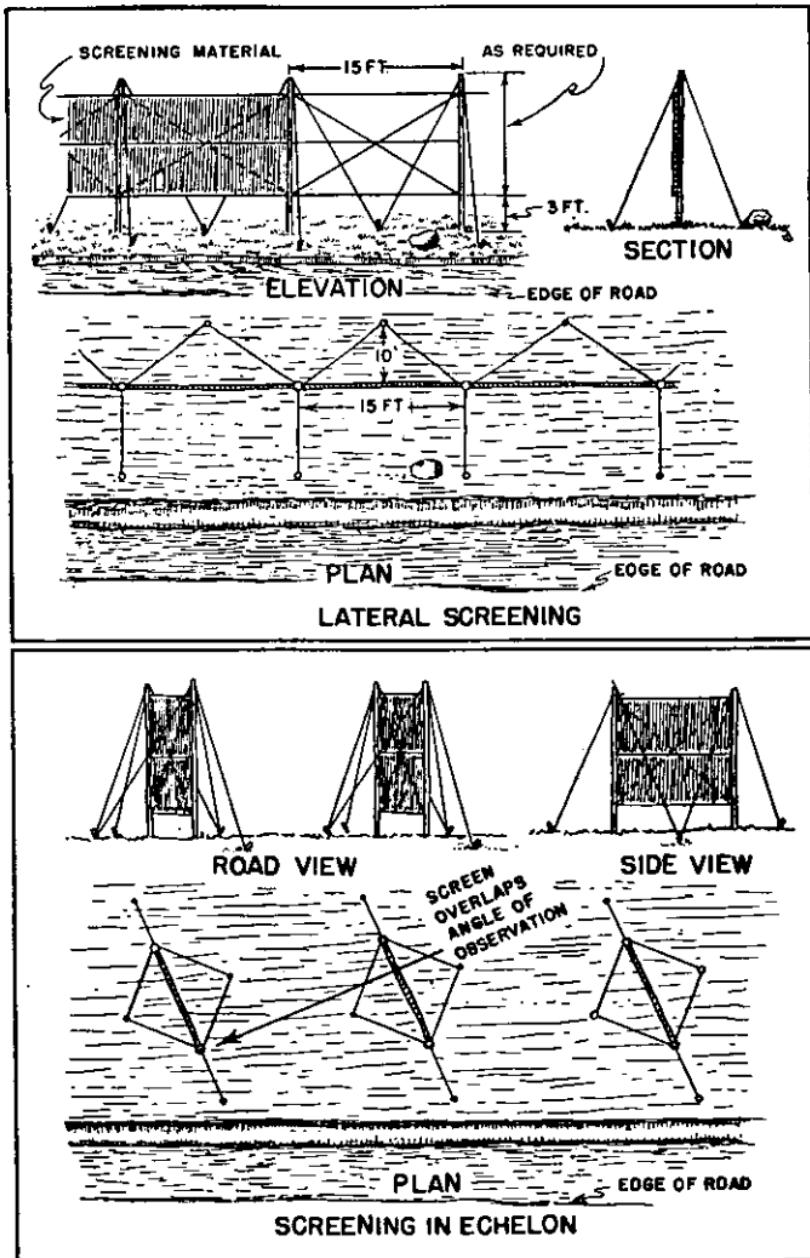


FIGURE 8.—Lateral and echelon road screens.

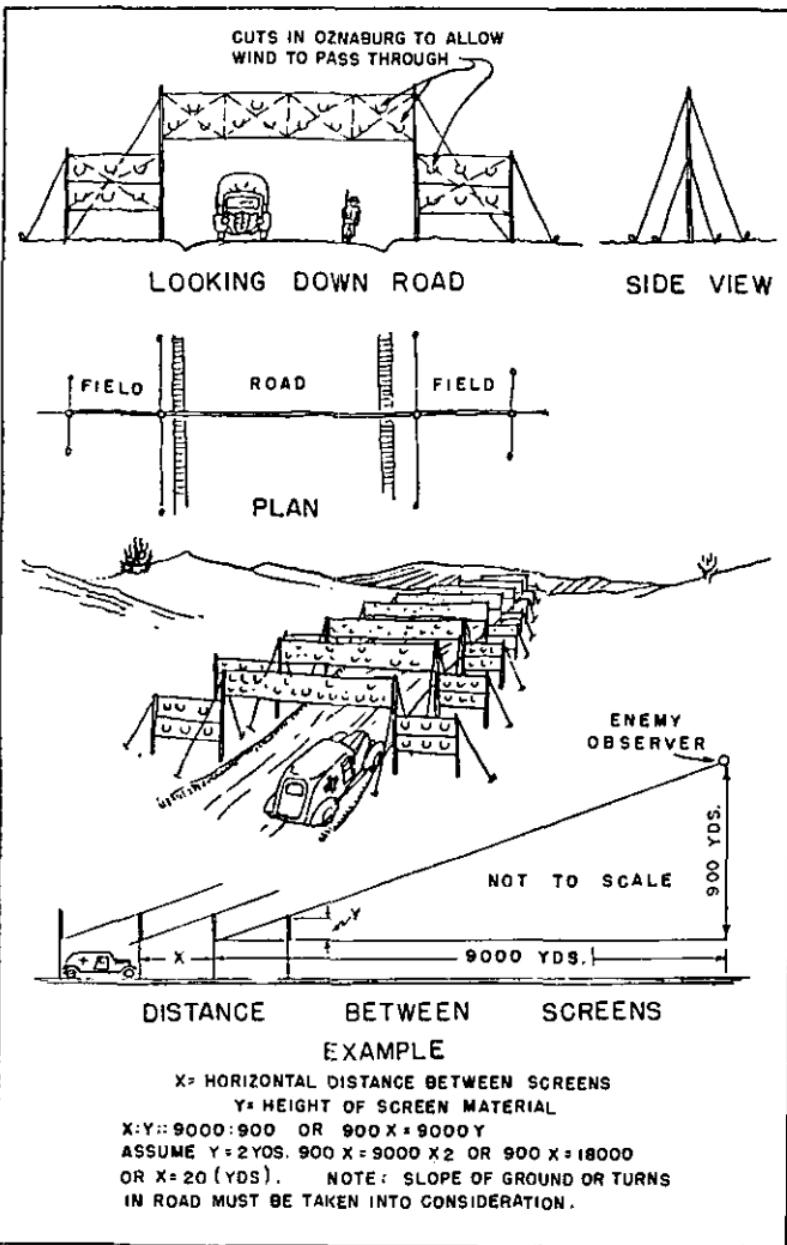


FIGURE 9.—Cross-screening.

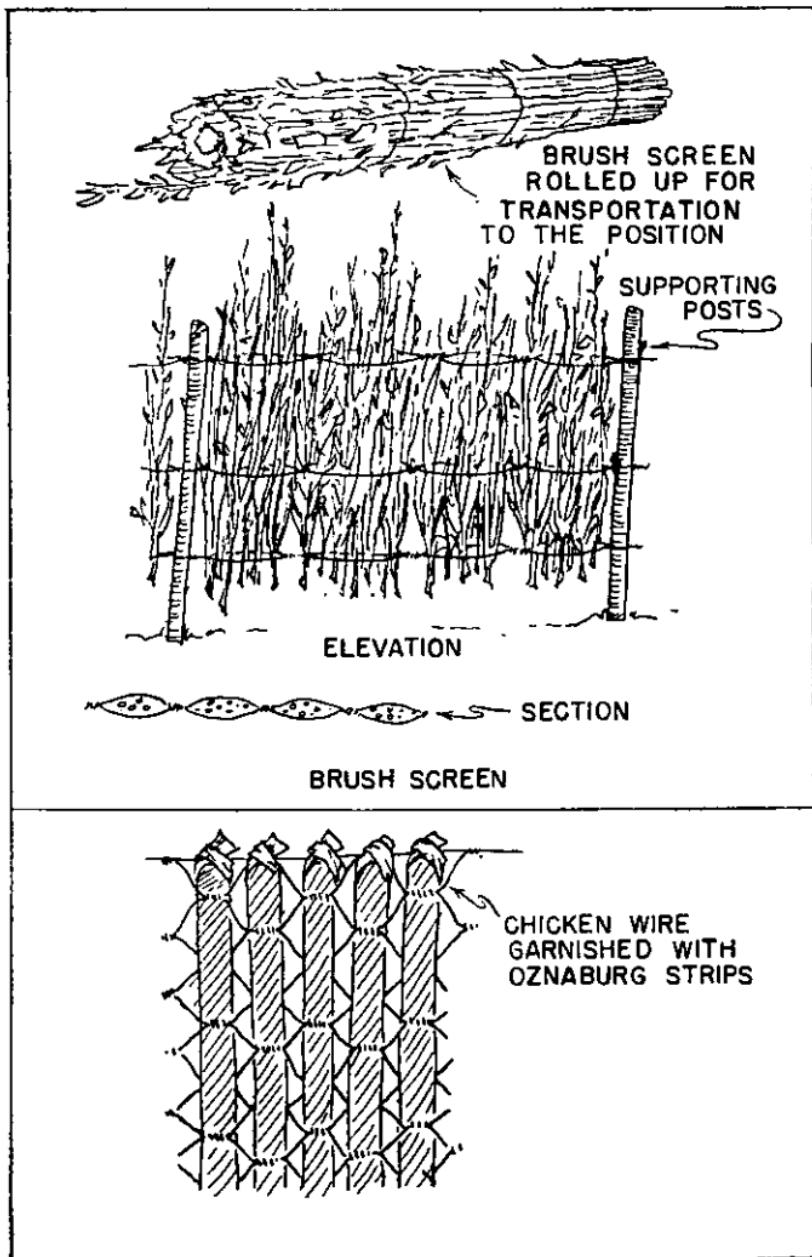


FIGURE 10.—Materials for road screens.

number of holes are necessary to let the wind blow through. These holes should be small and close together rather than large and unduly separated, otherwise even strong screens will blow over. Slashed oznaburg is temporary in nature because of the fraying action of wind.

f. The opacity necessary for road screening varies with the distance from the enemy observer. A good rule is that four-fifths of the surface of the screening should be opaque.

■ 18. SNOW CAMOUFLAGE.—*a.* Camouflage when snow is on the ground is much more difficult than at other times. The following points should be kept in mind: Trails get tracked with mud and melt out early, leaving a black line; snow falls through camouflage material and the holes show dark; the warm roofs of dugouts, etc., cause early melting of snow.

b. The remedies are as follows:

(1) When snow first falls keep activity at a minimum. Snow often melts quickly in places and it is only on the first clear morning that an unbroken white sheet exists. Enemy air observation is intensified at this time.

(2) Cover trails, dugout roofs, etc., with fresh snow. Renew this covering as often as needed. Cover camouflage with something to hold snow and then scatter snow thereon. The entire surface need not be covered, but the form should be broken up with the snow.

(3) Use white cloth in patches to cover the camouflage. Cloth in the quantities necessary would probably only be furnished for areas where snow lies unbroken on the ground for long periods.

■ 19. ESSENTIAL MEASURES.—*a.* Conduct the operations of installing a position so as not to change the aspect of the locality.

b. Avoid straight lines and, above all, avoid right angles.

c. Colors that match to the eye do not necessarily match photographically. Check the colors of nets by means of aerial photographs and correct them until they match the surrounding terrain.

d. Material lying flat photographs light, while material standing on end is full of shadows and photographs dark.

e. Do not cut natural materials in the immediate vicinity of a position as these cuttings may show up on aerial photographs.

f. Artificial materials are ordinarily preferable for positions which will be occupied for a long time.

g. The personnel which constructs camouflage must conduct their work so that their tracks fall within the camouflaged area.

h. Avoid making tracks or placing material under the portions of a net where the garnishing is thin.

i. Construct flat tops as close to the ground as possible in order to minimize shadows and to reduce their visibility when a stereoscope is used.

■ 20. SUPPLY DATA.—a. A 1½-ton truck can haul garnished nets as follows:

	Capacity (1 load)
Chicken wire camouflage, rolls-----	25
Fishnets, feet:	
36 by 44-----	25
45 by 45-----	20
30 by 30-----	40
22 by 22-----	80
12 by 12-----	200

b. The quantities of stakes and wire required for flat-top supports are shown below:

Item	Fishnets, 36 by 44 feet	Chicken wire, 1,000 square yards
Stakes, 2½ feet long, 3 inches in diameter.....	20.....	40 to 100. ¹
Poles (lengths as needed), 3 to 4 inches in diameter.....	18.....	80 to 100. ¹
Wire, No. 12 or larger, smooth.....	500 feet.....	6,000 feet.
Nails.....	½ pound.....	5 pounds.

¹ Depends on shape of cover.

c. One mile of lateral road screening, 12 feet high, requires the following materials:

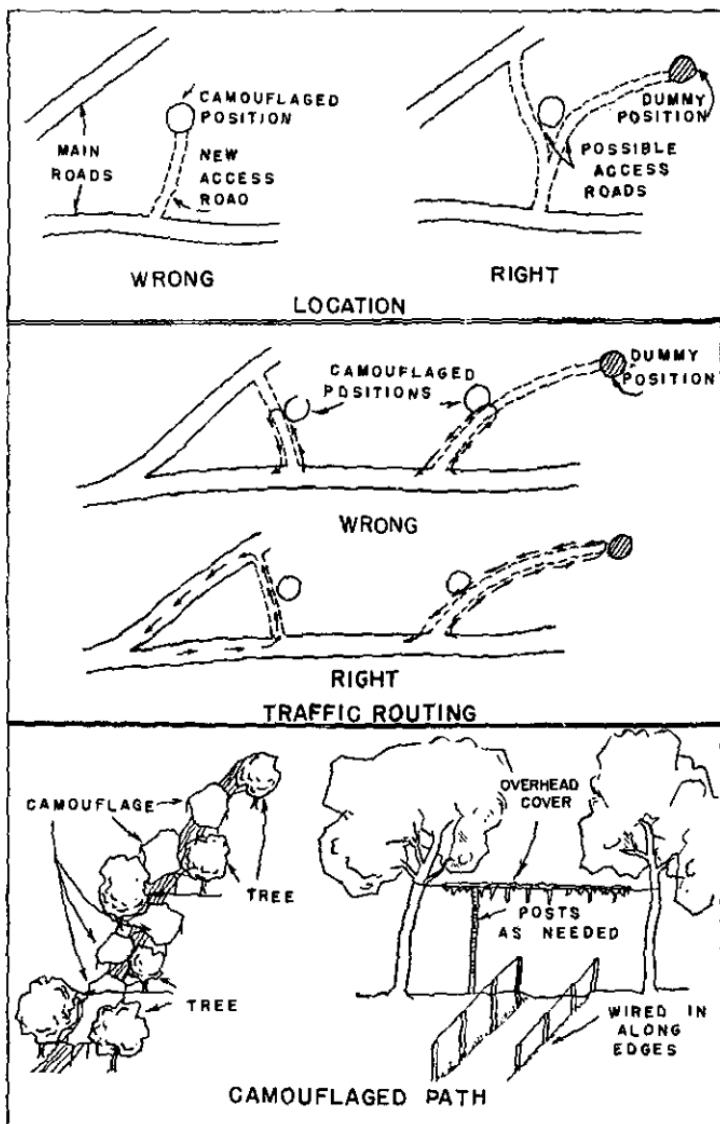
Poles, 12 to 15 feet, top diameter 2 inches.....	360
Stakes, 3 feet long, diameter 3 inches.....	750

Wire, No. 9 to No. 16, smooth, feet-----	30,000
Staples or nails-----	½ keg
Brush rolls, 12 feet wide, fabricated, yards-----	1,800
or	
Oznaburg, 40 inches wide, yards-----	7,200
or	
Chicken wire camouflage, 6 feet wide, yards-----	3,600

SECTION III

TYPICAL CAMOUFLAGE PRACTICE

- 21. GENERAL.—This section illustrates various methods of camouflaging some of the more common military works and installations under average terrain conditions and with the labor and materials normally available. The methods are described with reference to specific installations but they can, in most cases, be adapted successfully to other types of installations. Appropriate field manuals of the arms and services concerned should be consulted for specific details.
- 22. ROADS AND PATHS.—*a.* Existing roads and paths should not be camouflaged, as they will normally have been photographed by the enemy and any attempt at hiding them will attract attention. Where practicable, their use should be regulated by traffic routing and control so that their appearance is not changed due to widening of the traveled surface or destruction of bordering vegetation.
- b.* New roads and paths can be concealed for short distances only. For ease of concealment, choose routes which afford as much natural cover as possible. Where natural cover is scarce, follow existing surface lines such as fences and ditch banks, keeping on the north side of such objects so as to take advantage of their shadows. When artificial cover is necessary, use chicken wire or stretched wires on which camouflage material is placed in irregular patches. Never hide a road or path under a solid blanket of one material; break it up with irregular patches of different materials. These patches need not be contiguous. (See fig. 11.)



c. Concealed roads and paths *must* be wired in along both sides so that vehicles or personnel cannot make wide places or shortcuts which are not concealed. In many cases similar wiring is necessary for roads and paths not concealed, in order to prevent changes in their appearance in the vicinity of a camouflaged position. In wet weather the best way to keep a path from spreading wide is to lay down trench boards or cover it with cinders.

d. To prevent roads or paths needed for access to a position from disclosing its location—

(1) Choose routes which do not end at the position but go on past to a logical destination, such as a house, dummy position, or another road.

(2) Direct traffic so that access routes show uniform use throughout their length and not merely up to the position.

(3) Prevent any widening of routes at or near the position, such as is caused by vehicles parking or turning around on the shoulders of a road, or by personnel cutting corners at the mouth of a path. Preventive measures include—

(a) Wiring in paths and roads.

(b) Posting guards to prevent violations.

(4) Use existing routes wherever possible; when new routes are necessary they should either be concealed or should appear to have been built for some reason other than access to a position, such as a shortcut between two existing routes.

■ 23. RAILWAYS.—a. Main-line tracks, yards, etc., cannot be concealed without excessive work. Temporary lines can be hidden for short distances particularly if intended for light equipment which permits the use of much sharper curves and requires less disturbance of the ground to provide a roadbed. The same methods of camouflage are used as described in paragraph 22 for roads.

b. A railway system branching off from a main line and going to a military position should be located carefully so that it can be concealed; otherwise its presence will give the position away. For example, a spur run into a wood should take off where the main line is obscured in the woods.

■ 24. TELEPHONE AND TELEGRAPH LINES.—a. Telephone and telegraph lines leading to a concealed position, particularly where several lines approach the position from different di-

rections, will disclose the position unless concealed. In general, these lines should be located along or near existing paths or roads so that maintenance personnel need not make new paths which might show.

b. Lines on poles can be rendered inconspicuous by—

(1) Siting poles so that their shadows are broken up or absorbed by nearby trees, bushes, buildings, etc., or their shadows. Along the edge of a woods is generally a good location.

(2) Painting poles, particularly their tops, with a dark green or black flat paint.

(3) Concealing spoil from the pole holes by sodding or by scattering it on nearby paths or roads.

c. Buried lines can be hidden by—

(1) Siting the wire trenches under cover of hedges, trees, etc., when possible.

(2) Concealing the back-fill by sodding or by covering with irregular patches or brush or other camouflage material.

■ 25. BIVOUACS.—a. Shelter tents can usually be hidden by placing them irregularly among bushes and trees and by covering them over with brush and grass. Out in the open they may be grouped irregularly under a single cover of artificial camouflage material or of brush supported on wire. Large tents can be treated in a similar way. The irregular grouping of the tents to fit in with existing concealment is the most essential feature.

b. The concealment of bivouacs is much simpler in woods and villages than in the open. In thin woods use overhead cover of proper color, or cover tents with branches or brush, and avoid all regularity in placing tents or shelters. In villages utilize existing buildings, walls, basements, etc. A shelter in a tumble down or roofless enclosure may be disguised by leaning broken timbers against the wall above the shelter to represent fallen rafters, and scattering dirt, brick dust, or debris over the shelter. In yards, shelters should be placed near fences, hedges, or trees, and disguised with paint splotches, mud, brush, or grass.

c. When necessary to conceal a bivouac in the open, cover the area with camouflage material on a standard wire frame. About 5 square yards of cover per man is sufficient. In cover-

ing any large area, care must be taken to come exactly to the existing edge of a field. Partly covered fields, or those where edges of cover do not exactly coincide with existing boundaries, are very evident in photographs. When a cover occupies exactly the same area as the field underneath it, even if the color is not exactly the same, it appears in photographs as though some normal agricultural development had taken place.

■ 26. BUILDINGS.—*a.* Buildings on account of their height always cast strong shadows and as they have rectangular forms are easily picked out on aerial photographs. It is difficult to conceal a building, except a very small one, so that it will not show in a photograph.

b. Eighty percent of the value of the camouflage of buildings lies in their correct location. Woods should be used for locations of buildings to the utmost possible extent. If scattered clumps of trees or bushes exist, tie the buildings into them; avoid the open as far as possible. Never arrange buildings in rows or space them regularly.

c. A flat-roofed building is less visible than a peak-roofed one, because, with the sun on one side, the hard straight line in the latter between the side in light and that in shadow is very conspicuous. If new boards, bright tin, or corrugated iron are used for roofs, they must be painted in a flat color or daubed with tar or mud to remove the shining or conspicuous color. Old boards are better than new; rough boards are better than dressed. Tar paper is a good covering. After any conspicuous color is neutralized, pile bushes and brush irregularly on the roof. It is not necessary to cover it entirely, but by letting some brush extend beyond the roof lines the rectangular form is broken up. Increase this breaking up of form by placing bushes or brush on the ground, extending irregularly from the building. (See fig. 12.)

■ 27. DUMPS.—*a.* For large dumps in rear areas, scatter buildings irregularly in and around woods and clumps of trees so as to make poor bombing targets. A dump should not be near any landmarks easily visible at night, such as a large white building or a distinctive body of water.

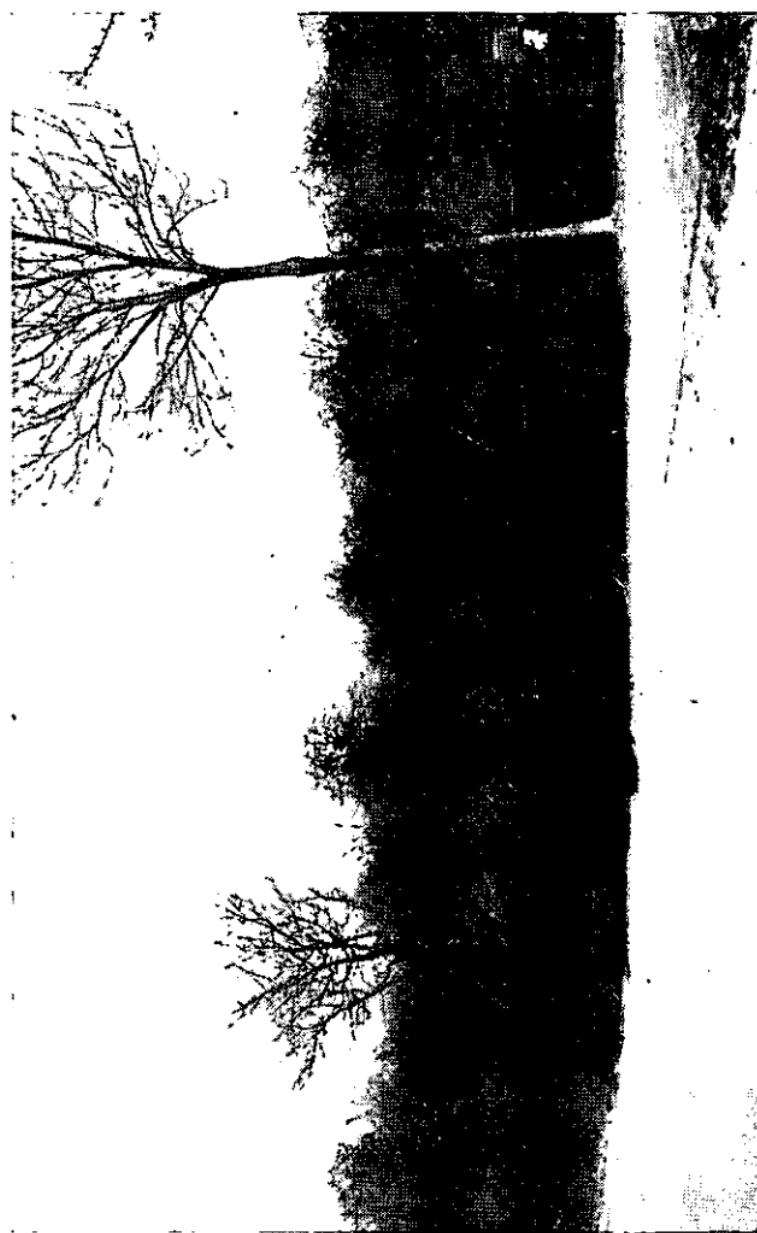


FIGURE 12.—Building concealed with brush.

b. For the smaller forward dumps— .

(1) Locate in places favorable for concealment such as woods, scattered brush or trees, or villages. Avoid important crossroads, lone buildings or groups of buildings, or the immediate vicinities of gun batteries.

(2) Lay out the dump so that the material is scattered and fits in with the natural features of the terrain as far as possible.

(3) Cover piles of material with sufficient screening to prevent the enemy from seeing the quantity of stores on hand.

(4) Restrict traffic so that tracks will not indicate the nature of the installation. If possible, provide return routes for vehicles so that their turning will not mark up the area.

(5) In heavy woods, stretch chicken wire between the trees at a height of 12 to 15 feet above the ground and place brush on this wire so as to conceal the roads and piles of material under the trees.

c. Figure 13 shows a dump which was not concealed. Great activity is shown here, three roads having been made where only one formerly existed. The dump can be plainly seen and recognized as such by the regularity of piles and box forms. The bottom sketch indicates how the dump might have been camouflaged.

■ 28. TRUCKS AND TANKS.—a. Trucks and tanks should use their mobility to get under natural cover wherever possible. They should always park in scattered, irregular formations. They are best concealed under heavy natural cover as in dense woods. In partly open country, they should be run into thin woods or a clump of trees or brush and either covered with brush, weeds, etc., or preferably draped with standard garnished fishnet. (See fig. 3.) In open fields, their identity can be hidden by a fishnet drape but they cannot be concealed. When used as a drape, the fishnet must be propped up off the truck or tank by brush or poles so that the shape of the object will not show through. The edges of the net should be held away from the truck or tank by being pegged to the ground or tied to bushes or trees.

b. Except on hard roads, trucks and tanks make characteristic tracks which are quite visible to aerial observers. These

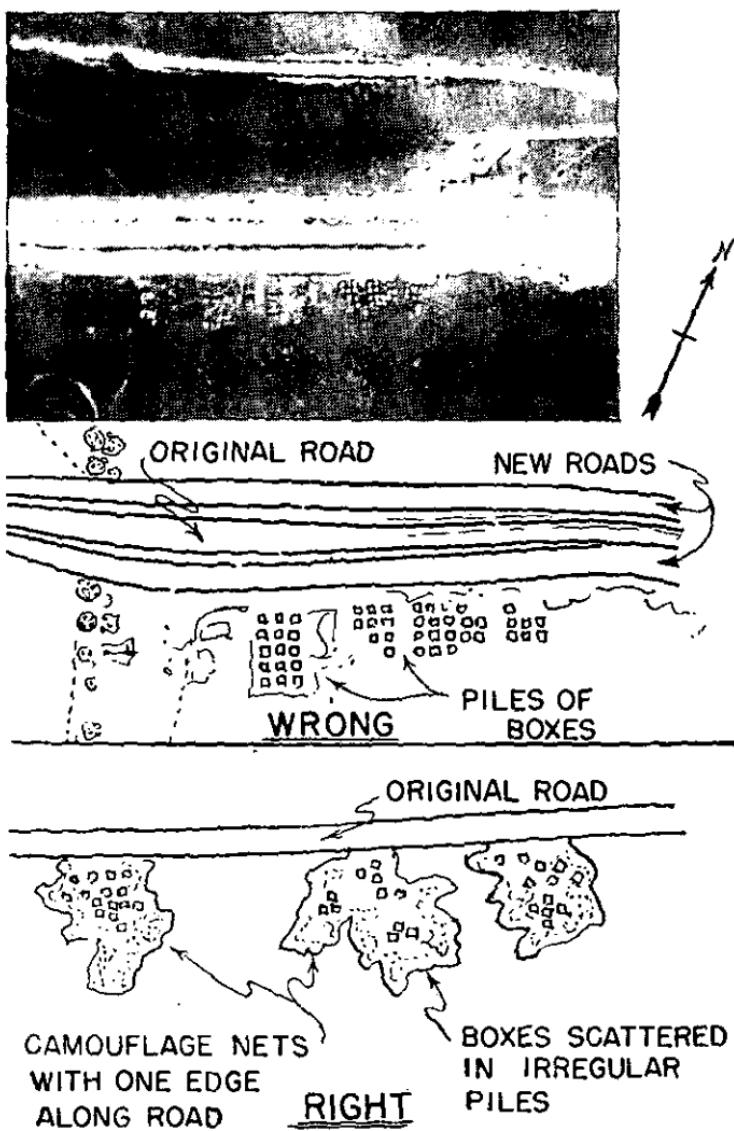


FIGURE 13.—Supply dump.

tracks should be effaced, particularly at the entrance to woods or other localities where the trucks or tanks are halted.

c. Both trucks and tanks should be painted in a flat neutral color as olive drab. Truck covers should be dark in color rather than light. When not in motion, all shiny parts such as headlights and windshields should be covered or obscured as by mud.

d. After camouflaging trucks or tanks, care should be taken not to make unconcealed paths leading to the place where they are located.

■ 29. OBSERVATION Posts.—*a.* Observation posts should be—

(1) Concealed in some existing structure or object, as in trenches, old buildings, cellars, trees, clumps of bushes, etc. (See fig. 14.)

(2) Located underground in the side of a hill where natural folds or slopes allow chambers and loopholes to be made from within, leaving the terrain undisturbed; access being provided through a shaft or tunnel with concealed entrance.

b. Loopholes should be irregular in shape and so constructed that light from behind does not show through. It is best to provide curtains to close the loopholes when not in use.

■ 30. INFANTRY SUPPORTING WEAPONS.—*a.* Machine guns are small and of themselves easy to hide. They are usually spotted by studying the probable fields of fire; a tangent of barbed wire, a road, a gulley, or a trench to be enfiladed. These limit the possible locations, making camouflage important. Machine-gun positions can be concealed by—

(1) Locating them in trenches which are part of a trench system. The V-shaped cuts in the parapets necessary for traversing the guns should be covered, or should have the shoulders sloped so as to eliminate shadows therefrom.

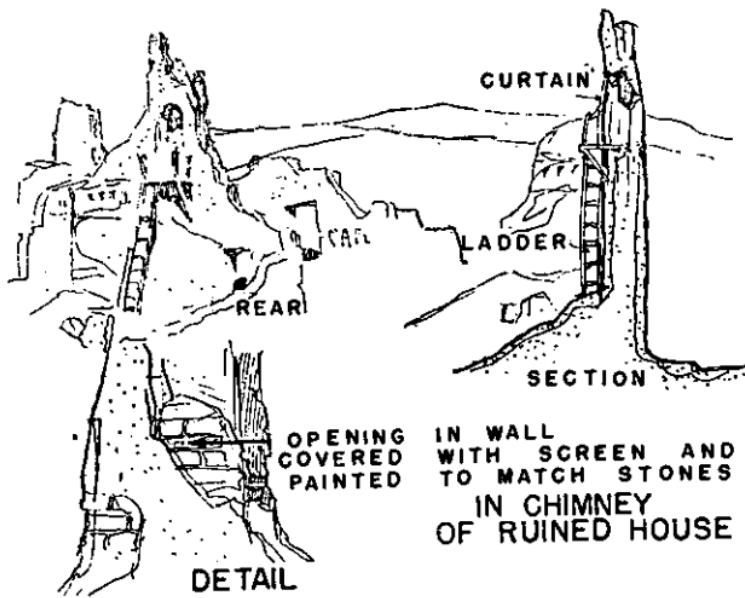
(2) Utilizing existing objects, such as trees, embankments (fig. 15), buildings, cellars, etc.

(3) Erecting artificial cover which looks like objects in the vicinity, as shell holes, clumps of bushes, etc. (See fig. 15.)

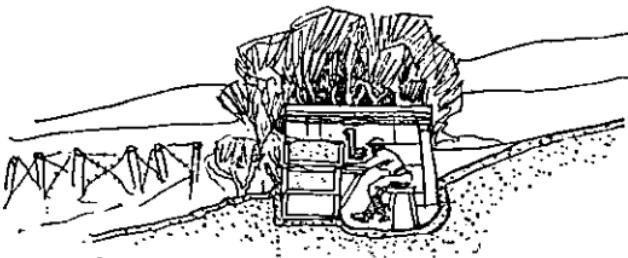
(4) Using standard 12- by 12-foot fishnets as flat-tops or drapes. Each net will cover one gun with crew but is too small to cover the spoil, which must be removed and hidden elsewhere. When under a flat-top, the gun should be dug in to reduce the height of cover.



IN WOODS



IN WALL
WITH SCREEN AND
TO MATCH STONES
IN CHIMNEY
OF RUINED HOUSE



IN A HEDGE

FIGURE 14.—Observation posts.

- (5) Using a single chicken wire flat-top to cover two or more guns. When a machine-gun emplacement is connected to a trench, the connecting sap must be concealed under

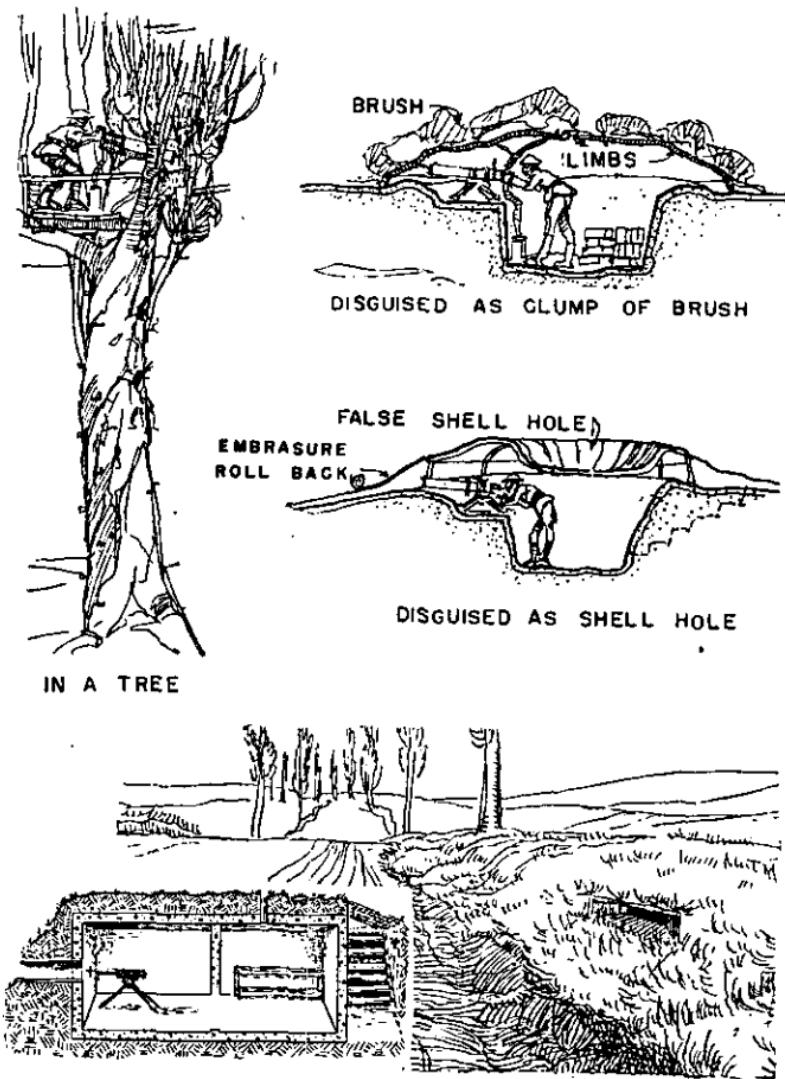


FIGURE 15.—Machine-gun positions.

camouflage. The entrance to the sap should be covered flush with the wall of the trench. (See fig. 16.)

b. Mortars are generally located to take full advantage of defilade so that they require only overhead cover to conceal them from air observation. Such cover is most easily provided by using a standard 12- by 12-foot fishnet as a flat-top.

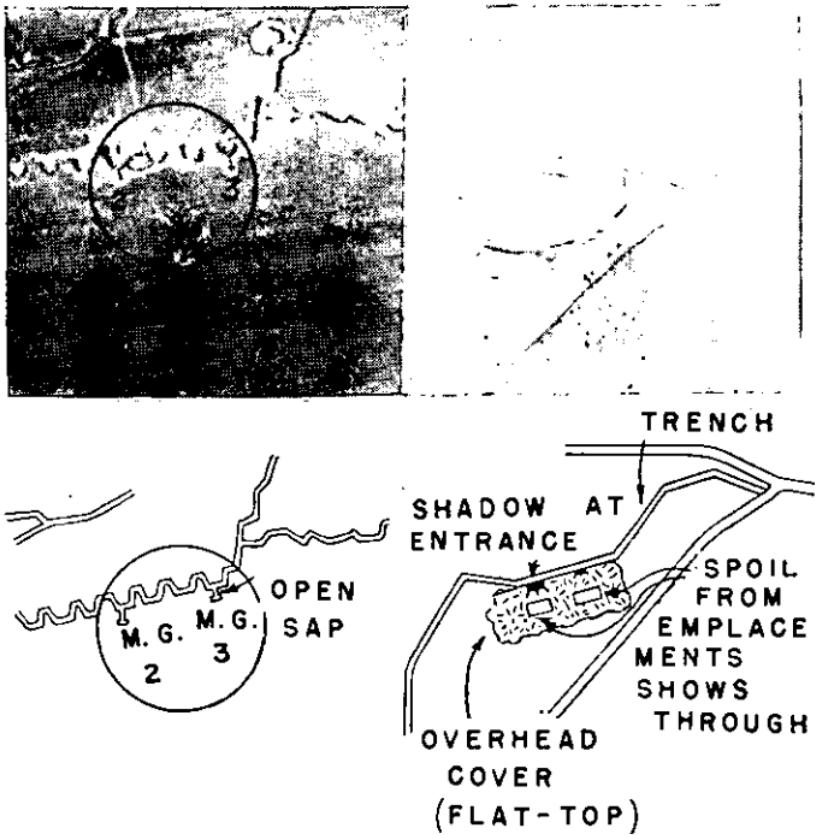


FIGURE 16.—Mistakes in machine-gun positions.

arranged so that it can be rolled back to permit firing. The mortar should be dug in to lower the height of net, and spoil should be disposed of away from the position.

c. Antitank guns (37-mm) and their prime movers (light trucks) are both provided with standard 22- by 22-foot fishnets. These are particularly useful in mobile situations, being

used to provide flat-tops for the guns and as drapes for the trucks. In a stable situation where the avenues of tank attack are definitely limited, the guns should be emplaced under camouflage of a more permanent nature.

■ 31. FIELD ARTILLERY.—*a.* In applying the general principles of camouflage to Field Artillery, any or all of the following general measures may be useful:

- (1) Scatter the guns irregularly to fit the accidents of the terrain.

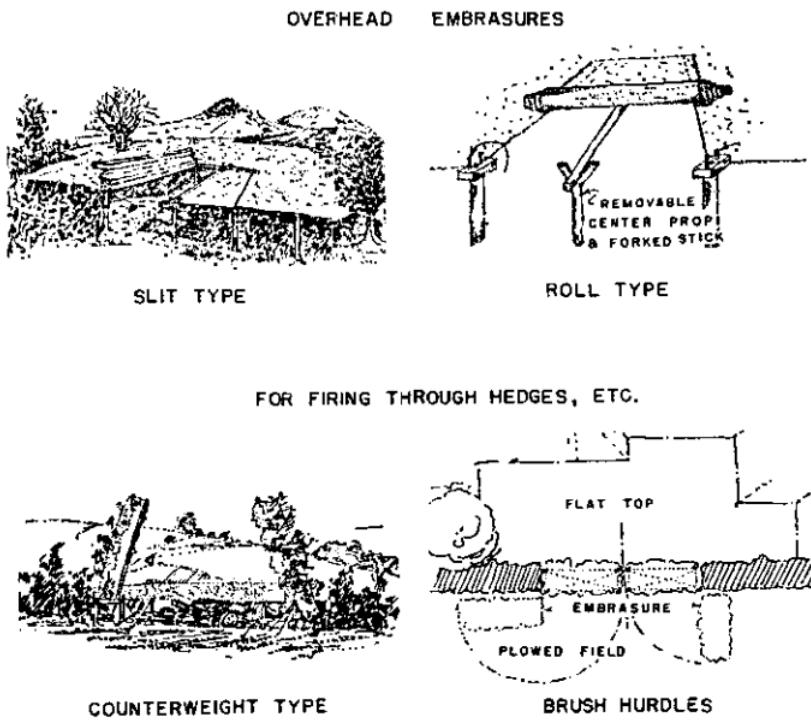


FIGURE 17.—Embrasures.

(2) Dig in the guns to reduce the height of the camouflage material above the ground.

(3) Provide embrasures which can be opened for the guns to shoot through and closed when the guns are not in use. (See fig. 17.) When fishnets are used, cut them *only if needed* to provide embrasures.

(4) Hide blast marks, in fields covered with vegetation, by covering them with branches held in place by stakes. In plowed fields, plow or spade the mark as fast as it gets beaten down. No blast marks occur when firing directly over a road, over bare, hard ground, or over rock.

RIGHT

WRONG

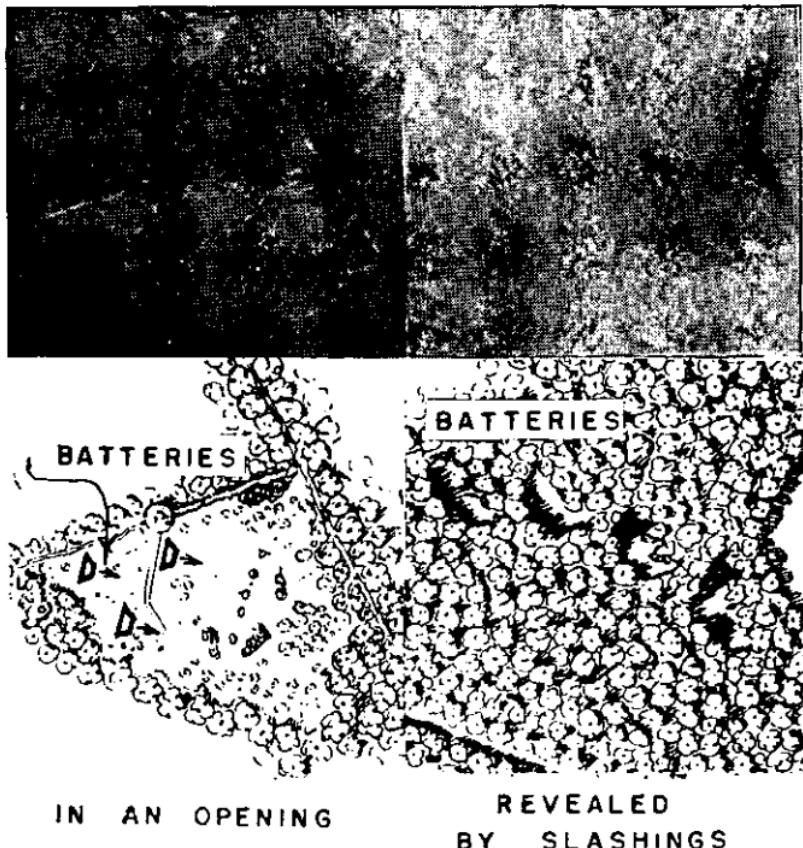


FIGURE 18.—Batteries in open space in woods.

(5) Use dummy positions to draw enemy fire, especially during snow periods and in stable sectors. Dummies must appear real to the enemy, otherwise they give him valuable negative information. They must be located so that fire di-

rected at them will not damage actual installations, allowing for reasonable inaccuracies of fire.

(6) Maintain at the guns only the men actually required to serve them. Keep other personnel under cover at a reasonable distance.

(7) Paint guns and vehicles in one solid neutral color which blends with the color scheme of the vicinity.

b. In heavy woods, batteries are most often revealed by slashings in the trees. To avoid these slashings, place the batteries in an open space in the woods under scattered trees, or find a place where the guns can fire over the tops of the trees without making cuts. (See fig. 18.) The edge of a wood nearest the enemy affords an excellent place to hide guns. Scattered woods afford excellent battery positions. Trees and bushes supplemented by brush or nets serve to hide a battery so as to make it very hard to locate. (See fig. 19.)

c. Batteries in and around buildings are best hidden with local material. Use enough boards, timbers, brush, or other material to break the form of the gun and gun pit. The concealment of these positions depends on irregular lay-out and camouflage discipline. (See fig. 20.)

d. In open terrain a few scattered trees, a clump or line of brush, an orchard, a hedge or tall weeds, grass or vines along a fence or ditch all help to hide the edges of camouflage material and to make it blend with its background. Make the camouflage covering fit the ground lines where possible, and where not, make the edges extremely irregular. Watch discipline with unusual care to keep traffic on concealed routes. One solution of the problem is to put all guns under a single sheet of material. This takes more time for erection, requires more material than placing guns separately, and makes a good target, since all guns are together. However, it has the advantage that all interbattery trails, ammunition, etc., are under cover and effectively concealed. Also the battery can easily be controlled. Hence, this method is often used, especially in stabilized situations. (See fig. 21.)

e. Heavy artillery requires better camouflage than lighter artillery because it remains in one position longer and requires a more elaborate firing position. These positions can

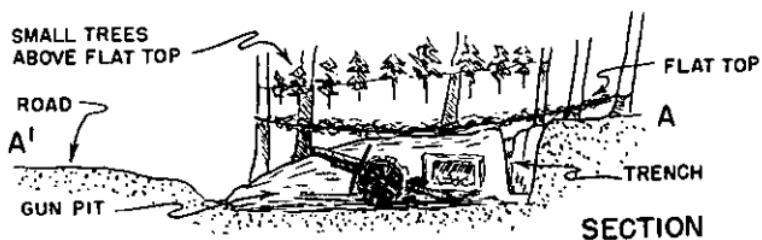
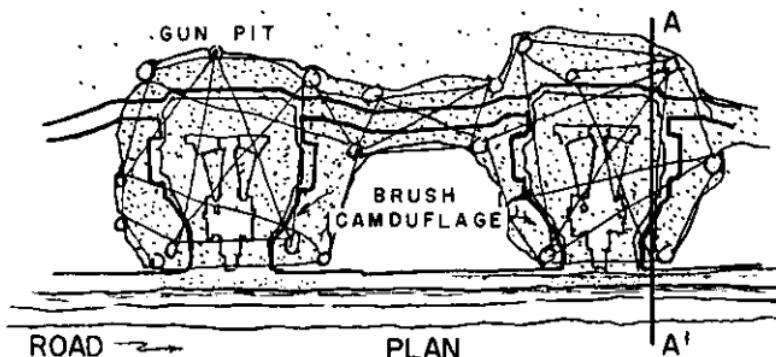


FIGURE 19.—Battery in edge of woods.

usually be well hidden because the long range of the guns permits a wider choice of positions.

■ 32. ANTIACRAFT BATTERIES.—*a.* An antiaircraft battery consists primarily of four guns, which must be able to fire through 360° of traverse and from horizontal to vertical in elevation; a director and a height finder, both of which must have fields of vision similar to the fields of fire of the guns; and a power plant which is connected to the guns and director by cables. The required fields of fire or vision prevent



FIGURE 20.—Gun hidden with debris.

the use of natural overhead cover for the guns, director, and height finder. The lengths of cable available limit their spacing or scattering.

b. The guns are best concealed under standard 36- by 44-foot fishnets erected at approximate trunnion height with the gun barrel projecting through a hole cut in the net so that the gun can be traversed and fired without removing the net. (See fig. 22.) A cover of natural materials supported by wires or chicken wire can be used to replace the fishnet.



PERSPECTIVE

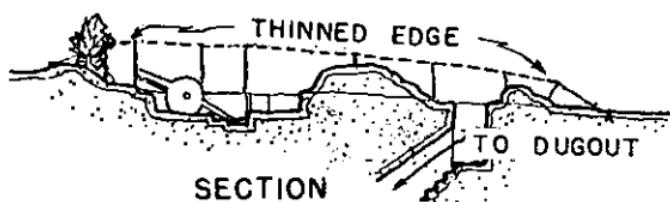
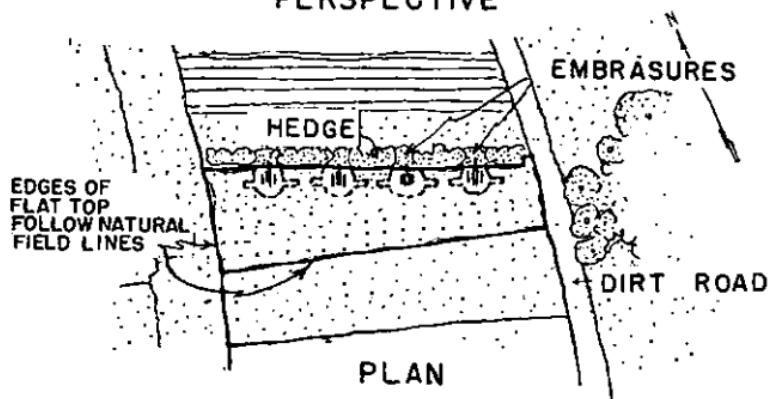


FIGURE 21.—Battery under single cover.

In either case, the camouflage should be tied in with some existing natural feature. Guns, particularly the barrels, should be painted with camouflage paint to match the cover. Guns are more readily concealed when their outriggers are dug in and platforms removed.

c. Directors and height finders are best concealed by fastening a small, light, rigid frame flat-top to each so as to traverse with the instrument without interfering with its operation. When desirable, instruments should be dug in to reduce the height of cover.

d. The power plant can usually be hidden under natural cover. Where no natural cover exists within the range of cable available, use a small flat-top. Cables, if not buried, should be laid along paths or under bushes, high grass, etc.; if buried, the trenches should be resodded and all spoil disposed of on paths or roads.

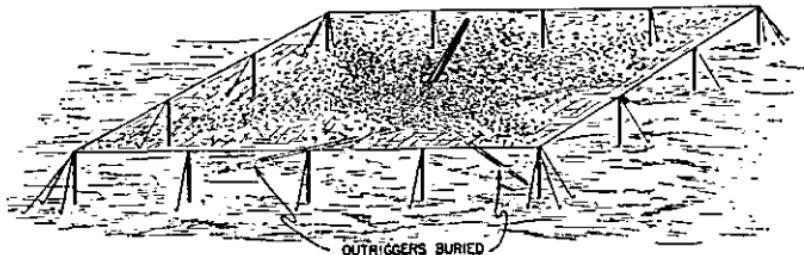


FIGURE 22.—Antiaircraft gun under fishnet.

■ 33. RAILROAD ARTILLERY.—a. Railroad artillery can be hidden only partially because firing positions are usually very large and very obvious. The camouflage of a railroad spur position involves a great deal of labor and material but can be done in case it is very important that the initial installation and firing be kept secret.

b. The following camouflage measures are practicable for protecting railroad artillery:

- (1) Provide a number of firing positions so that the guns can be moved quickly between positions.
- (2) Cover each firing position with enough material so that the enemy cannot see whether or not it is occupied.
- (3) Make the railway artillery equipment look like ordinary railway equipment.

■ 34. AIRDROMES.—*a.* An airdrome consists primarily of a landing field with runways, plus such hangars for repair and storage, shelter for personnel, and supply facilities as the particular situation requires. An airdrome is usually subject to air bombing only, and such bombing will be directed against the equipment and personnel at the airdrome as well as the landing field. Therefore camouflage measures should be designed to make both the landing field and the hangars and other facilities hard to find, and hence hard to hit, from the air.

b. A landing field can be made hard to locate from high altitudes by planting fields of grass of various colors so as to create the impression that the normal lines of adjacent fields continue across the landing field.

c. Hangars and other facilities can be concealed in two general ways:

(1) By scattering them widely and irregularly under natural cover, as in surrounding woods; reducing their visibility with flat, neutral paint; and covering them with brush or other material as needed to thicken the natural cover. Scattering is made more effective by locating hangars, etc., 300 to 500 yards from the landing field and taxiing the airplanes between the hangars and the field.

(2) By constructing them underground with minimum disturbance of the terrain and with entrances carefully concealed. This method requires a great amount of labor, but provides physical protection for airplanes and personnel if the airdrome is bombed. It is adaptable to the case where hills adjoin the landing field, so that the necessary storage space can be obtained by tunneling horizontally into the hills at the level of the landing field.

■ 35. AIRPLANES.—An airplane on the ground is best concealed by running it tail first under natural cover, such as the edge of a woods or a clump of trees or large bushes, and covering it with brush. (See fig. 23.) Fishnet drapes can be used in conjunction with the brush to break up the form of the airplane. When several airplanes are being hidden in one locality, they should be scattered as widely and irregularly as practicable. Where natural cover is insufficient, terraced flat-tops can be used to supplement it. Digging of pits for

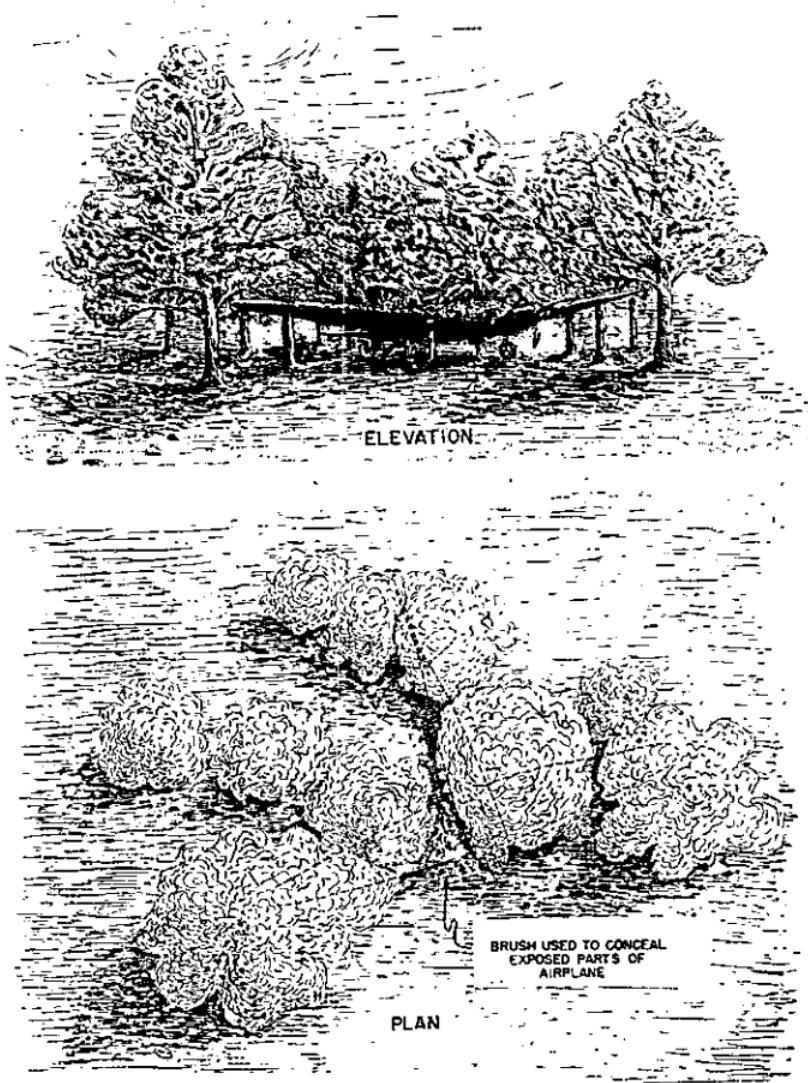


FIGURE 23.—Airplane under natural cover.

the wheels decreases the over-all height to be concealed. In all cases, tracks made by airplanes while taxying should be concealed or obscured.

■ 36. **LARGE SCALE DECEPTION**.—Dummy bases, dumps, camps, railways, and other military essentials, not too well or too crudely camouflaged, may be advantageously employed to mislead the enemy as to numbers, dispositions, and objectives.

■ 37. **MOBILE WARFARE**.—Camouflage is difficult in mobile warfare because time and labor are not available to conceal objects which move frequently. However, the principles of camouflage apply, particularly with respect to path and road discipline and seeking natural cover. To avoid hostile observation of all types, place objects and troops in woods; to avoid ground and balloon observation, locate them out of sight behind hills, forests, orchards, buildings, and other structures. Avoid high ground, as objects silhouetted against the sky or landscape make observation possible from great distances. Objects may be blended into a background by erecting screens of woven straw, hay, or dried leaves against a background of grass or woods.

SECTION IV

SUMMARY

■ 38. **GENERAL**.—*a.* Make camouflage effective primarily against aerial photographs.

(1) Hide form and shadow without changing texture or color.

(2) Do not make telltale tracks.

b. Consider mission, ease of access, natural concealment, defilade, and lay-out in choosing positions.

(1) Use aerial photographs to help locate positions.

(2) First look for natural cover; second for ground with a confused pattern.

(3) Plan lay-outs in detail before occupation.

c. Enforce camouflage discipline.

d. Use aerial photographs to check the effectiveness of camouflage.

■ 39. MATERIALS AND METHODS.—*a.* Tie camouflage to existing features.

b. Use natural materials wherever practicable.

(1) Place in natural positions.

(2) Keep green vegetation fresh.

c. Use fishnets for quick erection of flat-tops and drapes; use chicken wire for permanent flat-tops.

(1) Match colors to surroundings.

(2) Make flat-tops *flat*.

(3) Thin out garnishing near edges.

(4) Exaggerate irregularities of outline.

■ 40. CAMOUFLAGE PRACTICE.—*a.* Choose access roads and paths that will not give a position away.

(1) Use existing routes.

(2) Direct traffic *past* the position.

(3) Prevent widening *at* the position.

b. Locate large installations such as bivouacs, buildings, and dumps in dense woods whenever possible using irregular lay-outs.

c. Locate small installations such as observation posts and infantry weapons under natural cover or in existing structures whenever possible.

d. Run trucks and tanks under natural cover and cover them with fishnet drapes or natural materials.

e. Locate field artillery batteries in scattered woods or in the edge of a large woods whenever practicable.

(1) Scatter guns irregularly and dig them in.

(2) Hide blast marks.

(3) Avoid slashings.

f. Use overhead cover at trunnion height for antiaircraft guns.

g. Hide airplanes under natural cover reinforced by natural materials; scattering airplanes as much as possible.

h. Use dummies to mislead the enemy as to strength and dispositions.

